

MEMORANDUM

June 24, 2009

TO: Joshua Martin, Chairman
Phyllis Bernard
Julian Brix
SPP Board of Directors, Oversight Committee

FROM: Craig Roach
Stuart Rein
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SUBJECT: Rough Estimate of Residential Rate Impacts of Proposed Climate Change Regulations

INTRODUCTION

In the *2008 State of the Market Report* (SOM Report), and as part of our presentation to the Southwest Power Pool (SPP) Board of Directors (Board) on April 28, 2009, we provided an overview of proposed climate change legislation and its potential effect on the cost of producing electricity from coal- and natural gas-fired power plants. At the Board meeting Texas PUC Chairman Smitherman asked if we could take our analysis one step further to estimate the impact of carbon dioxide (CO₂) emissions costs on a typical residential customer's monthly bill. As directed by the Oversight Committee, the purpose of this memorandum is to respond to his request.

The analysis used to answer this question can be broken up into three steps. First, we conducted a review of recent developments in climate change regulation to come up with a reasonable range of possible CO₂ allowance costs. We developed our range from three sources: (a) the fourth Regional Greenhouse Gas Initiative (RGGI) Auction, (b) a Congressional Budget Office (CBO) analysis of the Waxman-Markey bill, and (c) President Obama's budget. Second, we estimated the impact of the range of CO₂ allowance costs on the cost to produce one megawatt-hour (MWh) of electricity from coal- and natural gas-fired resources. Third, we estimated how these incremental increases in production costs might translate to an average residential bill.

In summary, we estimate that potential CO₂ emissions costs could result in monthly bill increases anywhere from 2.5% to 15.1% for a typical residential customer. As explained in more detail below, these are meant to be only rough estimates of the impact. In addition, these estimates reflect the current mood in Washington which must balance global climate change policy with the current financial crisis.

REVIEW OF POTENTIAL CLIMATE CHANGE REGULATIONS

Key policymakers are pushing to enact legislation to put a price on CO₂ emissions. For example, the President's recent budget assumes revenues from a cap-and-trade system beginning in 2012.¹ In addition, Congress is thought to be moving towards a summer vote on cap-and-trade legislation.² Another key event is that, on April 17, 2009, the U.S. Environmental Protection Agency (EPA) released a proposed finding that greenhouse gases are threatening to the public health;³ this is a step towards regulation of such gases under the Clean Air Act that would not require Congressional authorization, but could spur Congress to act.

Table One shows a range of costs of an allowance to emit one ton of CO₂. The prices are reported in 2009 dollars. As seen in the table, we developed our range from three sources. The first estimate comes from the Regional Greenhouse Gas Initiative (RGGI), which is a cap-and-trade system used across 10 Northeastern states. This estimate, \$3.23, is the price of an allowance for 2009 from the fourth RGGI auction, conducted on June 17, 2009. The second estimate in Table One, \$13.26, represents the price of an allowance from the CBO's June 5, 2009 analysis of the Waxman-Markey bill. This bill was coauthored by U.S. House of Representatives Energy and Commerce Committee Chairman Waxman and Energy and Environment Subcommittee Chairman Markey. The third estimate in Table One, \$19.29, is derived from President Obama's budget estimates for a proposed national cap-and-trade system beginning in 2012.

¹ *A New Era of Responsibility: Renewing America's Promise*, February 26, 2009, Table S-6, at www.whitehouse.gov/omb/assets/fy2010_new_era/A_New_Era_of_Responsibility2.pdf.

² *The American Clean Energy and Security Act (H.R. 2454)* at http://energycommerce.house.gov/index.php?option=com_content&view=article&id=1633&catid=155&Itemid=55.

³ *Proposed Endangerment and Cause or Contribute Findings for Greenhouse Gases under the Clean Air Act*, at <http://epa.gov/climatechange/endangerment.html#proposed>.

TABLE ONE
RANGE OF POTENTIAL CO₂ EMISSIONS COSTS

Source of Cost Estimate	Cost of Allowance (\$/Ton of CO ₂)
RGGI	\$3.23
Waxman-Markey (June 5, 2009 CBO Analysis)	\$13.26
Obama Budget	\$19.29

- a) All prices are in 2009 dollars, calculated using consumer price index (CPI) data and forecasts from the Congressional Budget Office, March 2009.
- b) RGGI: The relatively low prices in RGGI are reportedly due to a cap which is at or possibly even above current emission levels and by measures to limit price increases above \$7 and \$10 per ton of CO₂. Prices are kept from being even lower because of a price floor, currently \$1.86 per ton, and because compliance periods last three years, so that allowances purchased today can be used to offset emissions in 2011.
- c) Waxman-Markey Estimates: This estimated cost of an allowance under the Waxman-Markey bill comes from a CBO Study. They estimate that the price of an allowance in 2011 would be \$15 per metric ton of CO₂. The price shown in the table is converted to short tons and is adjusted to 2009 dollars. *See Congressional Budget Office Cost Estimate, H.R. 2454 American Clean Energy and Security Act of 2009, June 5, 2009.* A separate estimate of allowance costs resulting from the Waxman-Markey bill was produced by the U.S. EPA. In this study, the EPA estimated that an allowance for 2015 would be between \$13 and \$17 per metric ton of CO₂ (2005\$). If we take the low end of this range (\$13) and convert it to short tons and 2009\$, we get an estimate of \$12.91 per ton of CO₂. We chose the low end of the range because modifications were made to the Waxman-Markey bill after the EPA's study, which would most likely result in lower emissions costs. *See EPA Preliminary Analysis of the Waxman-Markey Discussion Draft, The American Clean Energy and Security Act of 2009 in the 111th Congress, April 20, 2009 and EPA Memo, Ways in Which Revisions to the American Clean Energy and Security Act Change the Projected Economic Impacts of the Bill, May 17, 2009.*
- d) Obama Budget: Some news reports have stated that President Obama's budget assumes an initial allowance price in 2012 of \$20 per ton of CO₂. For example, see "Carbon Trading to Raise Consumer Energy Prices", The Wall Street Journal, February 27, 2009. The number in the table is adjusted to 2009 dollars.

The range of estimates in Table One (\$3.23 to \$19.29) are educated guesses about potential near-term costs of an allowance based on recent information. However, these are just estimates and could vary from actual prices under a cap-and-trade program for several reasons. First, there is still uncertainty over such things as the timing of a potential cap and trade program, how tight any cap may be, and how allowances will be allocated. Changes in any of these elements would affect the cost of an allowance. Second, given the current financial crisis, there has been pressure in Washington DC to contain the costs of any CO₂ emissions programs. This is evident in the fact that estimates of an allowance under the latest proposal, the Waxman-Markey bill, are lower than those under previous cap-and-trade proposals such as the Lieberman-Warner bill. When the economy begins to recover, adjustments could be made to once again increase the impact of any CO₂ programs. Third, cap-and-trade systems can lead to volatile price outcomes. For example, under Europe's cap-and-trade system there has been very volatile prices. The futures price for an allowance for 2009 in the European Union ETS, as of April 20, 2009, was \$16.99. The peak 2008 futures price for an ETS 2009 allowance was \$40.46 in 2009 dollars. This price was hit on July 1, 2008, before concerns about the economy drove demand and prices for allowances lower. The Chicago Climate Exchange also has seen volatility in its Carbon Financial Instruments (CFIs). On May 30, 2008, CFI contracts reached a record high of \$7.40 per metric ton CO₂ across all vintages, while in May 2009 CFI contracts were traded as low as \$1.10 per metric ton of CO₂. The difference between CO₂ emission prices in Europe and Chicago in 2008 and in 2009 illustrates the potential price volatility of cap-and-trade systems.

PRICE EFFECT ON ELECTRICITY PRODUCTION COSTS

The most direct effect of CO₂ emissions costs in SPP would be to increase the cost of producing electricity, which would, in turn, increase market prices. Table Two, below, attempts to quantify the impact of our range of CO₂ emissions costs on the cost of producing a MWh of electricity. As a rule of thumb we typically think that a new coal plant produces 0.95 tons of CO₂/MWh and a new natural gas combined cycle produces 0.42 tons of CO₂/MWh.⁴ Multiplying these numbers by the cost of allowance figures in Table One gives us an estimate of the price effect on producing electricity. As seen in columns two and three below, depending on what CO₂ allowance cost is presumed, the incremental cost increase of producing one MWh from a coal power plant ranges from \$3.06/MWh to \$18.30/MWh and the incremental cost increase of producing one MWh from a combined cycle natural gas power plant ranges from \$1.35/MWh to \$8.04/MWh. To put these numbers in context, in 2008 in the SPP EIS Market footprint, roughly 65.5% of the MWh produced were from coal-fired power plants, while 25.4% were from natural gas, and the remaining 9.1% were mostly from sources that do not emit CO₂, such as nuclear, wind, and hydro.⁵ Therefore, assuming this fuel mix, column four in Table Two provides an average estimate of the incremental cost increase of a typical MWh of electricity

⁴ These emissions levels were calculated using heat rates from EIA's 2009 Annual Energy Outlook and the amount of carbon per unit of fuel from the U.S. EPA's 2009 *U.S. Greenhouse Gas Inventory Report*. Emission levels were decreased by 1%, to assume a 99% burn rate, consistent with EIA methodology in *Carbon Dioxide Emissions from the Generation of Electric Power in the United States*, July 2000.

⁵ See Boston Pacific Company, Inc., 2008 *State of the Market Report, Southwest Power Pool, Inc.* (May 5, 2009) at page 56.

produced in the SPP EIS Market footprint. These numbers range from \$2.35/MWh for RGGI to \$14.02/MWh for the Obama budget.⁶

TABLE TWO
PRICE EFFECT OF CO₂ EMISSIONS COST
ON THE PRICE OF PRODUCING ELECTRICITY (\$/MWH)

Source of Cost Estimate	Coal	Natural Gas Combined Cycle	SPP Market Fuel Mix
RGGI	\$3.06	\$1.35	\$2.35
Waxman-Markey (June 5, 2009 CBO Analysis)	\$12.57	\$5.52	\$9.64
Obama Budget	\$18.30	\$8.04	\$14.02

As is clear from the table, there is a wide range of possible price effects from CO₂ pricing. Because natural gas generation produces fewer carbon emissions than does coal for each MWh produced, natural gas plants face smaller price impacts from CO₂ restrictions than do coal plants. For example, a standard natural gas combined cycle plant may face an effect only 44% that of a conventional coal plant. Because both coal- and natural gas-fired power plants produce over 90% of the electricity in SPP, the average price effect for a typical MWh in SPP is in between that of coal and natural gas.

ESTIMATED EFFECTS ON RESIDENTIAL ELECTRICITY RATES

The last step of our analysis was to translate the incremental production cost increases resulting from CO₂ allowance costs to residential monthly bills. To do this, we assumed that an allowance cost was incurred for all CO₂ emitted; this approach ignores the fact that some proposals (e.g. Waxman-Markey) distribute allowances for free for a portion of emissions. We also assume that all costs were passed through to ratepayers. Next, we gathered data for a typical residential ratepayer in the Public Service Company of Oklahoma’s (PSO) territory. We chose PSO because Oklahoma is central to SPP, and the PSO website provides public data for an average residential customer.

According to PSO’s factsheet, as of December 31, 2008, an average residential customer uses 13,264 kWh per year or 1.11 MWh per month.⁷ If we multiply the SPP impact (the far right column in Table Two) by 1.11 MWh we get an estimate for how much a typical customer’s bill would increase. As seen in Table Three, these impacts could range from \$2.61 to \$15.56 per month (or \$31 to \$187 per year). The Waxman-Markey proposal, which is currently being

⁶ Note that these estimates assume that all other factors remain constant. For example, this method does not account for any switching between fuel types resulting from CO₂ costs.

⁷ See <https://www.psoklahoma.com/about/serviceTerritory/documents/PSOFactSheet2009.pdf>

discussed in Congress, would result in approximately a \$10.70 increase in a typical monthly bill or a \$128 increase per year under our assumptions.⁸

**TABLE THREE
ESTIMATED RESIDENTIAL RATE IMPACT**

Source of Cost Estimate	Avg Monthly Bill Increase	Percent Increase
RGGI	\$2.61	2.5%
Waxman-Markey (June 5, 2009 CBO Analysis)	\$10.70	10.4%
Obama Budget	\$15.56	15.1%

Given that, as of December 31, 2008, an average PSO residential customer paid 9.29 cents/kWh (or \$92.9/MWh), these increases would result in their bills increasing anywhere from 2.5% to 15.1%. Once again, given the fact that no cap-and-trade program is in place yet, there is a significant amount of uncertainty surrounding these estimates. For example, as mentioned, the numbers in Table Three reflect our assumption that an allowance cost was incurred for every ton of CO₂ emitted. If instead we assume a large portion of the allowances are freely allocated to covered entities and states, the impact on customers could be somewhat dampened. The CBO study reports that only 30% of the allowances for 2012 would be auctioned for sale, with the remaining 70% being freely allocated. Assuming that power producers incurred emissions costs for only 30% of their production, the impact on customer bills from the Waxman-Markey bill would drop to approximately a \$3 per month increase representing about a 3% increase. On the other hand, there is also a lot of uncertainty that could push these estimates higher. For example, the CBO estimates that allowing domestic and international offsets, as permitted under the current Waxman-Markey proposal, resulted in lowering their estimates of the cost of allowances by \$35 or 69% in 2012.

IMPLICATIONS OF CURRENT CO₂ EMISSIONS COST ESTIMATES

The purpose of our analysis was to estimate the possible near-term impacts of climate change regulations on ratepayers based on the latest developments regarding a cap-and-trade program. By no means are we saying that this range of allowance costs (\$3.23 to \$19.29) will significantly reduce CO₂ emissions. For example, in PJM’s study on the impacts of federal climate change, they stated that, “Widespread switching from coal to combined cycle natural gas is not to be expected until a CO₂ price of around \$40/short ton is reached in the base gas price scenarios. This threshold increases as natural gas prices increase.”⁹ In addition, a 2006 report on the economics of climate change by the head of the British Government Economic Service (the

⁸ As mentioned previously, the EPA also performed an analysis of the Waxman-Markey bill. If we use the EPA’s numbers, we estimate that the average monthly bill increase would be \$10.41 and the percentage increase in monthly bill would be approximately 10.1%.

⁹ See PJM, *Potential Effects of Proposed Climate Change Policies on PJM’s Energy Market* (January 23, 2009) at page 7.

“Stern Report”) stated that reducing emissions to an acceptable level would result in a marginal cost of abatement of around \$25 to \$30 per ton of CO₂ emitted.¹⁰ Finally, the Electricity Reliability Council of Texas (ERCOT) recently produced a study on the impacts of CO₂ emissions in the ERCOT market. They stated that, “In the reference case, with \$7/MMBtu natural gas prices, expected load levels and the existing and committed level of wind and other generation, the carbon allowance costs must rise to between \$40 and \$60 per ton in order to reduce carbon emissions from electric generation in ERCOT to 2005 levels by 2013.”¹¹

If CO₂ allowance prices increased to these higher levels the impact on customers’ bills would be significantly higher. For example, if we use \$40/ton of CO₂ in our analysis, we estimate that it would result in an approximately 30% increase in an average residential customer’s monthly bill. This is about double the impact of the estimate derived from President Obama’s budget and about three times the impact of the Waxman-Markey bill. Therefore, we wanted to highlight the fact that in the future there is potential for even greater impacts on ratepayers than the 2.5% to 15.1% estimate discussed above.

It is also interesting to compare our estimates to those from the ERCOT study in order to see if we arrive at similar results. On the surface our numbers appear to be higher than ERCOT’s estimates. For example, as seen in Table Three, we estimate that an allowance cost of nearly \$20 (\$19.29) from President Obama’s budget would result in a \$15.56 increase in an average monthly bill, while ERCOT estimates a \$20 allowance cost would have a bill impact of only \$11.23.¹² However, in order to make a reasonable comparison between the studies we must first account for major differences in assumptions used in the two analyses. If we adjust the assumptions used in our analysis to be more in line with those used in ERCOT’s study we arrive at results that are similar to ERCOT’s.¹³ For example, after adjusting our assumptions, we estimate an allowance price of nearly \$20 from the Obama budget would result in an \$11.09 increase in an average monthly bill, which is very close to the \$11.23 reported in ERCOT’s study.

¹⁰ See Sir Nicholas Stern, *The Economics of Climate Change: The Stern Review* (October 30, 2006) at page 304.

¹¹ See ERCOT, *Analysis of Potential Impacts of CO₂ Emissions Limits on Electric Power Costs in the ERCOT Region* (“ERCOT Study”) (May 12, 2009) at page 1.

¹² See ERCOT Study at page 14.

¹³ In order to make a rough comparison between our study and ERCOT’s study we changed three assumptions in our model. First, and most importantly, we changed the fuel mix assumed in the analysis. Instead of assuming SPP’s fuel mix of 65.5% coal, 25.4% natural gas, and 9.1% non CO₂ emitting sources, we used ERCOT’s 2008 fuel mix (see ERCOT’s May 2009 quick facts) of 37% coal, 43% natural gas, and roughly 20% non CO₂ emitting sources. Second, we adjusted the monthly usage numbers for a typical residential customer from PSO’s 1.11 MWh per month to ERCOT’s estimate of 1 MWh per month. Third, we adjusted our numbers so that they were in the same year’s dollar as the ERCOT report.